



**BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA**

TECHNICAL MEMORANDUM

GROUNDWATER SCREENING CONCENTRATIONS

To: Mr. Brian Mossman
Boeing Realty Corporation
3760 Kilroy Airport Way, Suite 500
Long Beach, CA 90806

From: Haley & Aldrich, Inc.

Date: March 2, 2001

Re: Groundwater Screening Concentrations for the Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California

Haley & Aldrich, Inc. is herein providing this technical memorandum to describe the derivation of groundwater screening concentrations for use at the Boeing Realty Corporation's (BRC's) Former C-6 Facility in Los Angeles, California (subject property).

OVERVIEW/PURPOSE

The subject groundwater screening concentrations will be used as a tool by the groundwater team to assist with the assessment of groundwater plume delineation. The groundwater screening concentrations were derived for volatile organic compounds (VOCs) using conservative health-based assumptions for the vapor phase migration pathway.

Should groundwater VOC concentrations be less than the groundwater screening values, it is likely that no further action would be required by the regulatory agencies for groundwater concentrations to be protective of human health from the potential vapor migration exposure pathway. If chemical concentrations at the limits of the groundwater plume are greater than the groundwater screening concentrations, it is recommended that additional "step-out" groundwater samples be obtained. Potential human health risk will be quantified later during the performance of the site-specific risk assessments in accordance with the November 29, 2000 document entitled *Risk Assessment Work Plan, Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California* (Work Plan).

SUMMARY OF DERIVATION METHODOLOGY

Commercial/light industrial and residential groundwater screening concentrations were calculated for reasonable maximum exposure (RME) scenarios assuming upward VOC vapor migration and inhalation of indoor air. These groundwater screening concentrations were derived using the methodology described in the November 29, 2000 Work Plan, as detailed below.

The San Diego Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) vapor migration model was used to estimate indoor air concentrations. The Los Angeles Regional Water Quality Control Board (RWQCB) and the California Environmental Protection Agency (Cal-EPA) Office of

Environmental Health Hazard Assessment (OEHHA) verbally approved the use of this model for the subject property. Chemical parameters were obtained from online information sources including:

- the U.S. Environmental Protection Agency Region 9 preliminary remediation goal data sheets,
- the U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), and
- Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base.

Geotechnical input parameters including dry bulk density, total and air-filled porosity, and total organic carbon (TOC) were obtained from analysis of representative soil samples obtained on the subject property.

Exposure parameters for the RME scenarios were obtained from Section 7 of the November 29, 2000 Work Plan. Residential exposure parameters were weighted for a child (6 years, ages 1 through 6) and an adult (24 years) over a 30-year exposure period. It was assumed that impacts are present only in the shallowest encountered groundwater and extend beneath the entire footprint of a single-story structure. Model default parameters were used for concrete foundation attenuation factor (0.01), and the building air exchange rate (0.5 exchanges per hour for a residence, and 0.83 exchanges per hour for a commercial or industrial building).

Toxicity values were updated from the following online sources in order of priority:

1. Cal-EPA OEHHA, Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

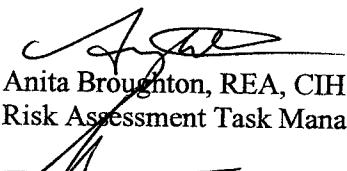
The various input parameters and model results are presented in Appendix A for the residential scenario and in Appendix B for the commercial/light industrial scenario.

GROUNDWATER SCREENING CONCENTRATIONS

The groundwater screening concentrations are presented in Table 1. These values are based on the lowest estimated groundwater concentration associated with either an excess lifetime cancer risk of one in a million (1×10^{-6}) or a hazard index of 0.33 for potential noncancer adverse health effects. Since the acceptable risk thresholds identified in the November 29, 2000 Work Plan are an excess lifetime cancer risk of 1×10^{-5} and a hazard index of 1.0, the groundwater screening concentrations have been developed to address possible compound additivity of adverse health effects when conducting the risk assessments.

Should you have any questions concerning the contents of this technical memorandum, please contact the undersigned at (619) 405-5436.

Sincerely yours,
HALEY & ALDRICH, INC.


Anita Broughton, REA, CIH
Risk Assessment Task Manager


Scott Zachary
Project Manager



Attachments:

- Table 1** Groundwater Screening Concentrations
- Appendix A** Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Residential Scenario
- Appendix B** Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Commercial/Light Industrial Scenario

**BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA**

TECHNICAL MEMORANDUM ADDENDUM NO. 1

GROUNDWATER SCREENING CONCENTRATIONS

To: Mr. Brian Mossman
 Boeing Realty Corporation
 3855 Lakewood Blvd.
 Building 1A MC D001-0097
 Long Beach, CA 90846

From: Haley & Aldrich, Inc.

Date: April 13, 2001

Re: Revised Table 1 of March 2, 2001 Groundwater Screening Concentrations Technical Memorandum, Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California

Haley & Aldrich, Inc. is providing this Technical Memorandum Addendum No. 1 to the Groundwater Screening Concentrations Technical Memorandum dated March 2, 2001. This addendum includes a revised Table 1 to the above-referenced March 2, 2001 Technical Memorandum.

Should there be any questions, please do not hesitate to contact the undersigned.

Sincerely yours,
HALEY & ALDRICH, INC.



Anita Broughton, CIH
 Risk Assessment Task Manager
 Industrial Environmental Group




Scott P. Zachary
 Project Manager
 Industrial Environmental Group

Attachment:

Revised Table 1

TABLE 1. Groundwater Screening Concentrations
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Residential (ug/L)	Commercial/ Light Industrial (ug/L)
79-01-6	Trichloroethylene (TCE)	12500	31600
127-18-4	Tetrachloroethylene (PCE)	3650	9250
75-09-2	Methylene Chloride	131000	333000
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	2860000	6040000
75-35-4	1,1-Dichloroethylene (1,1-DCE)	232	588
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	435000	917000
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	405000	855000
75-01-4	Vinyl Chloride	127	321
75-34-3	1,1 - Dichloroethane (1,1-DCA)	42700	108000
79-00-5	1,1,2 - TCA	25200	63700
71-43-2	Benzene	2050	5180
67-66-3	Chloroform	14500	36800
100-41-4	Ethylbenzene	13000000	27400000
78-93-3	Methyl Ethyl Ketone	773000000	1630000000
1634-04-4	MTBE	655000000	1380000000
91-20-3	Naphthalene	1200000	2540000
108-88-3	Toluene	2000000	4220000
75-69-4	Trichlorofluoromethane (Freon 11)	314000	663000
1330-20-7	Xylenes	5210000	11000000
107-06-2	1,2-Dichloroethane (EDC)	14800	37400
75-71-8	Dichlorodifluoromethane	95000	200000
56-23-5	Carbon tetrachloride	295	747

CAS = Chemical Abstract Service

Revised April 9, 2001

TABLE 1. Groundwater Screening Concentrations
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Residential (ug/L)	Commercial/ Light Industrial (ug/L)
79-01-6	Trichloroethylene (TCE)	12500	31600
127-18-4	Tetrachloroethylene (PCE)	3650	9250
75-09-2	Methylene Chloride	131000	333000
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	2860000	6040000
75-35-4	1,1-Dichloroethylene (1,1-DCE)	232	588
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	435000	917000
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	405000	855000
75-01-4	Vinyl Chloride	127	321
75-34-3	1,1 - Dichloroethane (1,1-DCA)	42700	108000
79-00-5	1,1,2 - TCA	25200	63700
71-43-2	Benzene	2050	5180
67-66-3	Chloroform	14500	31600
100-41-4	Ethylbenzene	13000000	9250
78-93-3	Methyl Ethyl Ketone	773000000	333000
1634-04-4	MTBE	655000000	6040000
91-20-3	Naphthalene	1200000	588
108-88-3	Toluene	2000000	917000
75-69-4	Trichlorofluoromethane (Freon 11)	314000	855000
1330-20-7	Xylenes	5210000	321
107-06-2	1,2-Dichloroethane (EDC)	14800	108000
75-71-8	Dichlorodifluoromethane	95000	63700
56-23-5	Carbon tetrachloride	295	5180

CAS = Chemical Abstract Service

Appendix A

Appendix A

Input Parameters and Model Results for Derivation of Groundwater Screening Concentrations – Residential Scenario

SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - RESIDENTIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Groundwater Screening Concentration ($\mu\text{g/L}$)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.5E-03	1.25E+04
127-18-4	Tetrachloroethylene (PCE)	1.0E-06	1.2E-02	3.65E+03
75-09-2	Methylene Chloride	1.0E-06	6.5E-03	1.31E+05
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	No Slope Factor	3.3E-01	2.86E+06
75-35-4	1,1-Dichloroethylene (1,1-DCE)	1.0E-06	1.5E-03	2.32E+02
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	No Slope Factor	3.3E-01	4.35E+05
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	No Slope Factor	3.3E-01	4.05E+05
75-01-4	Vinyl Chloride	1.0E-06	1.2E-03	1.27E+02
75-34-3	1,1 - Dichloroethane (1,1-DCA)	1.0E-06	3.1E-03	4.27E+04
79-00-5	1,1,2 - TCA	1.0E-06	1.1E-02	2.52E+04
71-43-2	Benzene	1.0E-06	1.5E-03	2.05E+03

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethlyene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	7.61E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.25E+04 ug/l
Henry's Law Constant	H	=	4.20E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	5.25E+03 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.20E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	6.07E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.25E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.61E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	1.54E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.26E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.26E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.50E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.50E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.65E+03	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.74E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K _d	=	1.74E+01	cm3/gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.74E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.47E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	7.30E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	5.98E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	5.98E-04 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	4.76E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.19E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.19E-04 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	1.19E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.76E-05 mg/kg-day
Slope factor (potency)	SF	=	2.10E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methylene Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	5.72E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.31E+05 ug/l
Henry's Law Constant	H	=	9.00E-02 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.18E+04 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	9.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.00E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	6.45E-01 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.18E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	2.04E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	4.36E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.58E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.58E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.85E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	7.12E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.12E-04 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
Hazard Index	HI	=	6.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.85E-04 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	9.96E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,1-Trichloroethane (1,1,1-TCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	1.63E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.86E+06 ug/l
Henry's Law Constant	H	=	7.10E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.03E+06 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	7.10E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	9.04E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.03E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.59E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	5.86E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	4.81E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	4.81E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.82E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.56E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.56E-02 mg/kg-day
Reference dose	RfD	=	2.90E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.82E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	7.78E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.32E+02 ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.55E+02 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	4.20E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.55E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.83E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	8.50E-03 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	6.97E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 6.97E-05 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	5.54E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.39E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.39E-05 mg/kg-day
Reference dose	RfD	=	9.10E-03 mg/kg-day
Hazard Index	HI	=	1.52E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.54E-06 mg/kg-day
Slope factor (potency)	SF	=	1.80E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	2.40E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	4.35E+05 ug/l
Henry's Law Constant	H	=	1.70E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	7.40E+04 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.60E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.32E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.40E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.51E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	2.03E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.66E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.66E-02 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.32E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.30E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-03 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.32E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: trans-1,2-Dichloroethylene (trans-1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	5.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	4.05E+05 ug/l
Henry's Law Constant	H	=	3.80E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.54E+05 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.80E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.45E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.54E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.10E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.45E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	4.04E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.32E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.32E-02 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.64E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.59E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.59E-03 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.64E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Version: November 1999

Risk Calculations

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Vinyl Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	6.30E+04 mg/mole
Vapor pressure	VP	=	3.50E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.27E+02 ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.40E+02 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.90E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.23E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.40E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.10E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	2.24E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	5.69E-03 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	4.66E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.66E-05 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.71E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.27E-06 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.27E-06 mg/kg-day
Reference dose	RfD	=	7.43E-03 mg/kg-day
Hazard Index	HI	=	1.25E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.71E-06 mg/kg-day
Slope factor (potency)	SF	=	2.70E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION**A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.90E+04	mg/mole
Vapor pressure	VP	=	3.08E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	4.27E+04	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	9.82E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.42E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 9.82E+03 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.51E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.69E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	2.20E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.20E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.39E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.39E-04 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.13E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-04 mg/kg-day
Slope factor (potency)	SF	=	5.70E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,2 - TCA

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	3.10E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.52E+04	ug/l
Henry's Law Constant	H	=	3.70E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	9.32E+02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	3.70E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	9.50E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.45E-02	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.13E-03	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 9.32E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.59E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.69E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	2.21E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.21E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.76E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.39E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.39E-05 mg/kg-day
Reference dose	RfD	=	4.00E-03 mg/kg-day
Hazard Index	HI	=	1.10E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.76E-05 mg/kg-day
Slope factor (potency)	SF	=	5.70E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Benzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.80E+04 mg/mole
Vapor pressure	VP	=	1.25E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.05E+03 ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	4.72E+02 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.20E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	4.00E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.72E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.79E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	1.54E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.26E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.26E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.50E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.50E-05 mg/kg-day
Reference dose	RfD	=	1.70E-02 mg/kg-day
Hazard Index	HI	=	1.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-05 mg/kg-day
Slope factor (potency)	SF	=	1.00E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f _{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA290176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA290176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA290176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA290176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05
Average				1.47						
Notes:										
The air-filled porosity values were calculated from gravimetric data, not volumetric data.										

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

1.47 0.45 0.19 0.26 645 0.06

CHEMICAL PARAMETERS

CAS No.	MW (mg/mole)	H ⁺ (dimension-less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ¹	Chronic RfD (inh) (mg/kg-day)
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	7.9E-02	a	7.6E-02	20	b
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	7.2E-02	a	2.4E-02	25	b
75-09-6	Methylene Chloride	8.5E+04	a	9.0E-02	1.0E-01	a	5.7E-01	25	b
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	7.8E-02	a	1.6E-01	25	b
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	9.0E-02	a	7.8E-01	25	b
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	7.4E-02	a	2.4E-04	20	b
156-50-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	7.1E-02	a	5.2E-01	30	b
75-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	1.1E-01	a	3.5E+00	25	b
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	7.4E-02	a	3.1E-01	25	b
79-00-5	1,1,2-TCA	1.3E+05	a	3.7E-02	7.8E-02	a	3.1E-02	25	b
71-43-2	Benzene	7.8E+02	a	2.3E-01	8.8E-02	a	1.2E-01	25	b
67-66-3	Chloroform	1.2E+05	a	1.5E-01	1.0E-01	a	2.6E-01	25	b
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	7.5E-02	a	1.3E-02	25	b
78-93-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	9.0E-02	a	1.2E-01	25	b
1634-04-4	MTBE	8.5E+04	a	2.4E-02	8.0E-02	a	3.3E-01	25	b
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	5.5E-02	a	1.0E-04	25	b
108-88-3	Toluene	9.2E+04	a	2.7E-01	8.7E-02	a	3.7E-02	25	b
75-69-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	8.7E-02	a	1.0E+00	25	b
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	7.0E-02	a	1.1E-02	25	b
107-06-2	1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	1.0E-01	a	1.1E-01	25	b
75-77-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	8.0E-02	a	5.8E+00	21	b
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	7.8E-02	a	1.5E-01	25	b

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
 b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
 c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
 e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/b2588/riskassess.htm>
 Toxicity Value reference priority:
 1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/b2588/riskassess.htm>
 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - RESIDENTIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Groundwater Screening Concentration ($\mu\text{g/L}$)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.5E-03	1.25E+04
67-66-3	Chloroform	1.0E-06	1.5E-03	1.45E+04
100-41-4	Ethylbenzene	No Slope Factor	3.3E-01	1.30E+07
78-93-3	Methyl Ethyl Ketone	No Slope Factor	3.3E-01	7.73E+08
1634-04-4	MTBE	No Slope Factor	3.3E-01	6.55E+08
91-20-3	Naphthalene	No Slope Factor	3.3E-01	1.20E+06
108-88-3	Toluene	No Slope Factor	3.3E-01	2.00E+06
75-69-4	Trichlorofluoromethane (Freon 11)	No Slope Factor	3.3E-01	3.14E+05
1330-20-7	Xylenes	No Slope Factor	3.3E-01	5.21E+06
107-06-2	1,2-Dichloroethane (EDC)	1.0E-06	1.3E-03	1.48E+04
75-71-8	Dichlorodifluoromethane	No Slope Factor	3.3E-01	9.50E+04
56-23-5	Carbon tetrachloride	1.0E-06	2.4E-02	2.95E+02

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION**A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.25E+04	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	5.25E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm3/gm
Soil/water distribution coef.	K _d	=	6.07E+00	cm3/gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.25E+03 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.61E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.54E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.26E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.26E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.50E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.50E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Chloroform

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.59E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.45E+04	ug/l
Henry's Law Constant	H	=	1.50E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.18E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.42E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.18E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	2.04E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.05E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	6.60E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 6.60E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	5.25E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.31E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.31E-04 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	1.53E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.25E-05 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Ethylbenzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.10E+05 mg/mole
Vapor pressure	VP	=	1.26E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.30E+07 ug/l
Henry's Law Constant	H	=	3.20E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	4.16E+06 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.20E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.29E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.16E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.53E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	1.15E+02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	9.47E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 9.47E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	7.53E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.88E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-01 mg/kg-day
Reference dose	RfD	=	5.70E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	7.53E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methyl Ethyl Ketone

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.20E+04 mg/mole
Vapor pressure	VP	=	1.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	7.73E+08 ug/l
Henry's Law Constant	H	=	1.10E-03 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	8.50E+05 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E-03 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	9.50E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.45E-02 cm ³ /gm
Soil/water distribution coef.	K _d	=	6.13E-03 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.50E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.83E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	2.83E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	2.32E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.32E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.85E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.62E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.62E-02 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.85E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

Risk Calculations

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: MTBE

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	3.29E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	6.55E+08 ug/l
Henry's Law Constant	H	=	2.40E-02 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.57E+07 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.40E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.00E+00 cm ³ /gm
Soil/water distribution coef.	K _d	=	3.87E-01 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.57E+07 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.63E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	4.65E+02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.82E+00 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.82E+00 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.04E-01 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	7.59E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.59E-01 mg/kg-day
Reference dose	RfD	=	2.30E+00 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.04E-01 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

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Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Naphthalene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	1.00E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.20E+06 ug/l
Henry's Law Constant	H	=	2.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.40E+04 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.20E+03 cm ³ /gm
Soil/water distribution coef.	K _d	=	7.75E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.40E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	5.90E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.20E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	5.24E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Version: November 1999

Risk Calculations

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	4.30E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.30E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.42E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	8.55E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.55E-04 mg/kg-day
Reference dose	RfD	=	2.60E-03 mg/kg-day
Hazard Index	HI	=	3.29E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.42E-04 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.20E+04 mg/mole
Vapor pressure	VP	=	3.74E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.00E+06 ug/l
Henry's Law Constant	H	=	2.70E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	5.40E+05 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	9.50E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.45E-02 cm ³ /gm
Soil/water distribution coef.	K _d	=	6.13E-03 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.40E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.77E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	1.74E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.43E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.43E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.13E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.84E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.84E-02 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.13E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Trichlorofluoromethane (Freon 11)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION**A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.40E+05 mg/mole
Vapor pressure	VP	=	1.05E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.14E+05 ug/l
Henry's Law Constant	H	=	4.00E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.26E+06 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.60E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.03E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.26E+06 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.77E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	4.04E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m³/hr
Indoor air component	C_i	=	3.32E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.32E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m³/day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.64E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.59E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.59E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.64E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Xylenes

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	1.05E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	5.21E+06	ug/l
Henry's Law Constant	H	=	3.00E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.56E+06	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	3.00E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.29E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.56E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.43E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	4.05E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.32E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.32E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
 Chemical Intake (carc. risk)	 IT _c	=	 2.64E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.64E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Version: November 1999

Risk Calculations

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,2-Dichloroethane (EDC)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	1.14E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.48E+04 ug/l
Henry's Law Constant	H	=	4.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	5.92E+02 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.45E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.92E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	2.04E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	2.19E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.80E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.80E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days

Chemical Intake (carc. risk)

$$IT_c = 1.43E-05 \text{ mg/kg-day}$$

Chemical Intake (non-carc. risk)

$$IT_{nc} = 3.57E-05 \text{ mg/kg-day}$$

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.57E-05 mg/kg-day
Reference dose	RfD	=	2.70E-02 mg/kg-day
Hazard Index	HI	=	1.32E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.43E-05 mg/kg-day
Slope factor (potency)	SF	=	7.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Dichlorodifluoromethane

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	5.77E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	9.50E+04	ug/l
Henry's Law Constant	H	=	4.10E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.90E+05	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.80E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.74E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.90E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.63E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.15E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	9.45E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 9.45E-02 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	7.52E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.88E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-02 mg/kg-day
Reference dose	RfD	=	5.70E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	7.52E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Carbon tetrachloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.50E+05 mg/mole
Vapor pressure	VP	=	1.51E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.95E+02 ug/l
Henry's Law Constant	H	=	1.20E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.54E+02 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.20E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.50E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	9.68E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.54E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.59E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	1.02E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	8.38E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 8.38E-05 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	6.67E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.67E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.67E-05 mg/kg-day
Reference dose	RfD	=	6.86E-04 mg/kg-day
Hazard Index	HI	=	2.43E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.67E-06 mg/kg-day
Slope factor (potency)	SF	=	1.50E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f_{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA290176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA290176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA290176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA290176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05
Average				1.47					0.45	0.19
									0.26	645
									0.06	0.06

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.	MW (mg/mole)	H' (dimension-less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ¹	Chronic RfD (inh) (mg/kg-day)
79-01-6 Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	20	b	9.4E+01	a
127-18-4 Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	25	b	2.7E+02	a
75-09-2 Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	25	b	1.0E-01	a
71-55-6 1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	25	b	1.4E+02	a
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	25	b	6.5E+01	a
156-59-2 cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	20	b	2.4E+04	a
156-60-5 trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	25	b	5.2E+01	a
75-01-4 Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E-01	25	b	3.5E+00	a
75-34-3 1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	25	b	1.9E+01	a
79-00-5 1,1,2 - TCA	1.3E+05	a	3.7E-02	a	7.8E-02	25	b	3.1E-02	a
71-43-2 Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	25	b	1.2E-01	a
67-66-3 Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	25	b	2.6E-01	a
100-41-4 Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	25	b	1.3E-02	a
78-93-3 Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	25	b	1.2E-01	a
1634-04-4 MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	25	b	3.3E-01	a
91-20-3 Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	25	b	1.0E-04	a
108-89-3 Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	25	b	3.7E-02	a
75-69-4 Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	a	8.7E-02	25	b	1.0E+00	a
1330-20-7 Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	25	b	1.1E-02	a
107-06-2 1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	25	b	1.1E-01	a
75-71-8 Dichlorodifluoromethane	1.2E+05	a	4.1E+00	a	8.0E-02	21	b	5.8E+00	a
56-23-5 Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	25	b	1.5E-01	a

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>

c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.isd.ornl.gov/cgi-bin/tox/TOX_select?select=csf

e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>

3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

Appendix B

Appendix B

**Input Parameters and Model Results for Derivation of Groundwater Screening
Concentrations – Commercial/Light Industrial Scenario**

SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	or	Hazard Index (=3.3E-01)	Groundwater Screening Concentration (ug/L)
79-01-6	Trichloroethylene (TCE)	1.0E-06		1.8E-03	3.16E+04
127-18-4	Tetrachloroethylene (PCE)	1.0E-06		1.4E-02	9.25E+03
75-09-2	Methylene Chloride	1.0E-06		7.8E-03	3.33E+05
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	No Slope Factor		3.3E-01	6.04E+06
75-35-4	1,1-Dichloroethylene (1,1-DCE)	1.0E-06		1.8E-03	5.88E+02
156-59-2	cis-1,2-Dichloroethylene (cis-1,2-DCE)	No Slope Factor		3.3E-01	9.17E+05
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	No Slope Factor		3.3E-01	8.55E+05
75-01-4	Vinyl Chloride	1.0E-06		1.5E-03	3.21E+02
75-34-3	1,1 - Dichloroethane (1,1-DCA)	1.0E-06		3.9E-03	1.08E+05
79-00-5	1,1,2 - TCA	1.0E-06		1.3E-02	6.37E+04
71-43-2	Benzene	1.0E-06		1.8E-03	5.18E+03

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.16E+04	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.33E+04	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.07E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.33E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.61E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	3.88E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.92E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.92E-03 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.00E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.00E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.76E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	9.25E+03	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	6.94E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K _d	=	1.74E+01	cm3/gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.94E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.47E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.85E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	9.13E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 9.13E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	4.76E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.43E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.43E-04 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	1.43E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.76E-05 mg/kg-day
Slope factor (potency)	SF	=	2.10E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methylene Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	5.72E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.33E+05	ug/l
Henry's Law Constant	H	=	9.00E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.00E+04	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	9.00E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.00E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.45E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.00E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	2.04E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.11E+00	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	5.48E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	5.48E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.86E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	8.58E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.58E-04 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
Hazard Index	HI	=	7.80E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.86E-04 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,1-Trichloroethane (1,1,1-TCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	1.63E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	6.04E+06	ug/l
Henry's Law Constant	H	=	7.10E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	4.29E+06	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	7.10E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	9.04E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.29E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.59E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.24E+02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	6.11E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 6.11E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	3.19E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.57E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.57E-02 mg/kg-day
Reference dose	RfD	=	2.90E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.19E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	5.88E+02	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	6.47E+02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	4.20E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.47E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.83E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.15E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.06E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.06E-04 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	5.55E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.67E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.67E-05 mg/kg-day
Reference dose	RfD	=	9.10E-03 mg/kg-day
Hazard Index	HI	=	1.83E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.55E-06 mg/kg-day
Slope factor (potency)	SF	=	1.80E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	2.40E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	9.17E+05 ug/l
Henry's Law Constant	H	=	1.70E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.56E+05 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.60E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.32E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.56E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.51E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	4.27E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	2.11E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.11E-02 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.10E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.30E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-03 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.10E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** trans-1,2-Dichloroethylene (trans-1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION**A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	5.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	8.55E+05 ug/l
Henry's Law Constant	H	=	3.80E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.25E+05 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.80E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.45E-02 cm ³ /gm
Soil/water distribution coef.	K _d	=	4.17E-03 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.25E+05 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.10E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.45E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	8.54E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.22E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	4.22E-02 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.20E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-03 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.20E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Vinyl Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	6.30E+04	mg/mole
Vapor pressure	VP	=	3.50E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.21E+02	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.53E+02	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.90E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.23E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.53E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.10E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	2.24E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	1.44E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	7.10E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 7.10E-05 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	3.70E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.11E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.11E-05 mg/kg-day
Reference dose	RfD	=	7.43E-03 mg/kg-day
Hazard Index	HI	=	1.50E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.70E-06 mg/kg-day
Slope factor (potency)	SF	=	2.70E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	3.08E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.08E+05 ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	2.48E+04 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	3.42E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.48E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.51E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	6.80E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	3.36E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.36E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	5.26E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	5.26E-04 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.76E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-04 mg/kg-day
Slope factor (potency)	SF	=	5.70E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,2 - TCA

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	3.10E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	6.37E+04	ug/l
Henry's Law Constant	H	=	3.70E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.36E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	3.70E-02	dimensionless
Bulk density (dry)	ρ_b	=	1.47E+00	gm/cc
Air-filled porosity	θ_a	=	1.92E-01	dimensionless
Water-filled porosity	θ_w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	7.50E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	4.84E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.36E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ_a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.59E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	6.80E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	3.36E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m

Outdoor air component

$$C_o = 0.00E+00 \text{ mg/m}^3$$

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.36E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	5.26E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	5.26E-05 mg/kg-day
Reference dose	RfD	=	4.00E-03 mg/kg-day
Hazard Index	HI	=	1.32E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-05 mg/kg-day
Slope factor (potency)	SF	=	5.70E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Benzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.80E+04 mg/mole
Vapor pressure	VP	=	1.25E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	5.18E+03 ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.19E+03 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.20E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	4.00E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.19E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.79E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	3.88E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.92E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.92E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.00E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.00E-05 mg/kg-day
Reference dose	RfD	=	1.70E-02 mg/kg-day
Hazard Index	HI	=	1.76E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-05 mg/kg-day
Slope factor (potency)	SF	=	1.00E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f _{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA29176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA29176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA29176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA29176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05

Average

1.47

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.	MW (mg/mole)	H' (dimension-less)	D _a (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ¹	Chronic RID (inh) (mg/kg-day)								
79-01-6 Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	20	b	9.4E+01	a	1.1E+03	a	1.0E-02	c	1.7E-01	e		
127-18-4 Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	25	b	2.0E+02	a	2.1E-02	c	1.0E-02	e				
75-09-2 Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	25	b	1.3E+04	a	3.5E-03	c	1.1E-01	e				
71-55-6 1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	25	b	1.4E+02	a	1.3E+03	a	2.9E-01	e				
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	25	b	6.5E+01	a	2.3E+03	a	1.8E-01	a	9.1E-03	e		
156-59-2 cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	20	b	3.6E+01	a	3.5E+03	a	na	a,c	1.0E-02	a		
156-60-5 trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	30	b	3.8E+01	a	6.3E+03	a	na	a,c	2.0E-02	a		
75-01-4 Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E-01	a	3.5E+00	25	b	1.9E+01	a	2.80E+03	a	2.7E-01	c	7.4E-03	e
75-34-3 1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	31	b	5.3E+01	a	5.1E+03	a	5.7E-03	c	1.4E-01	a		
79-00-5 1,1,2 - TCA	1.3E+05	a	3.7E-02	a	7.8E-02	25	b	3.1E-02	a	4.4E+03	a	5.7E-02	c	4.0E-03	a		
71-43-2 Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	25	b	6.2E+01	a	1.8E+03	a	1.0E-01	c	1.7E-02	e		
67-66-3 Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	a	2.6E-01	25	b	5.3E+01	a	7.9E+03	a	1.9E-02	c	8.6E-02	e
100-41-4 Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	25	b	1.3E-02	a	2.0E+02	a	1.7E+02	a	na	a,c	5.7E-01	e
78-93-3 Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	a	1.2E-01	25	b	4.5E+00	a	2.7E+05	a	na	a,c	1.4E-01	c
1634-04-4 MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	33	E-01	25	b	6.0E+00	a	1.5E+05	a	na	a,c	2.3E+00	e
91-20-3 Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	a	1.0E-04	b	1.2E+03	a	3.1E+01	a	na	a,c	2.6E-03	e	
108-88-3 Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	37	E-02	25	b	1.4E+02	a	5.3E+02	a	na	a,c	8.6E-02	e
75-69-4 Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E-00	a	8.7E-02	a	1.0E-01	25	b	1.6E+02	a	1.1E+03	a	na	a,c	2.0E-01	e
1330-20-7 Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	a	1.1E-02	25	b	2.0E+02	a	1.6E+02	a	na	a,c	2.0E-01	e
107-06-2 1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	a	1.1E-01	25	b	3.8E+01	a	8.5E+03	a	7.0E-02	c	2.7E-02	e
75-71-8 Dichlorodifluoromethane	1.2E+05	a	4.1E-00	a	8.0E-02	a	5.8E+00	21	b	5.8E+01	a	2.8E+02	a	na	a,c	5.7E-02	a
56-23-5 Carbon tetrachloride	1.5E+05	a	1.2E-00	a	7.8E-02	a	1.5E-01	25	b	1.5E+02	a	7.9E+02	a	1.5E-01	c	6.9E-04	e

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
- Toxicity Value reference priority:
 1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF GROUNDWATER SCREENING CONCENTRATIONS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index (=3.3E-01) or	Groundwater Screening Concentration (ug/L)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.8E-03	3.16E+04
67-66-3	Chloroform	1.0E-06	1.8E-03	3.68E+04
100-41-4	Ethylbenzene	No Slope Factor	3.3E-01	2.74E+07
78-93-3	Methyl Ethyl Ketone	No Slope Factor	3.3E-01	1.63E+09
1634-04-4	MTBE	No Slope Factor	3.3E-01	1.38E+09
91-20-3	Naphthalene	No Slope Factor	3.3E-01	2.54E+06
108-88-3	Toluene	No Slope Factor	3.3E-01	4.22E+06
75-69-4	Trichlorofluoromethane (Freon 11)	No Slope Factor	3.3E-01	6.63E+05
1330-20-7	Xylenes	No Slope Factor	3.3E-01	1.10E+07
107-06-2	1,2-Dichloroethane (EDC)	1.0E-06	1.6E-03	3.74E+04
75-71-8	Dichlorodifluoromethane	No Slope Factor	3.3E-01	2.00E+05
56-23-5	Carbon tetrachloride	1.0E-06	2.9E-02	7.47E+02

Notes:

The indicated groundwater screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the groundwater screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated groundwater screening concentrations may be greater than the water saturation (solubility) concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.16E+04	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.33E+04	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.07E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.33E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.61E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	3.88E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.92E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.92E-03 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.00E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.00E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.76E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Chloroform

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.59E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.68E+04	ug/l
Henry's Law Constant	H	=	1.50E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	5.52E+03	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.42E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.52E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	2.04E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	2.04E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.01E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.01E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	5.26E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.58E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.58E-04 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	1.84E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.26E-05 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Ethylbenzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.10E+05 mg/mole
Vapor pressure	VP	=	1.26E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.74E+07 ug/l
Henry's Law Constant	H	=	3.20E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	8.77E+06 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.20E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.29E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.77E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.53E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	2.43E+02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.20E+00 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.20E+00 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	6.27E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.88E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-01 mg/kg-day
Reference dose	RfD	=	5.70E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.27E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methyl Ethyl Ketone

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.20E+04	mg/mole
Vapor pressure	VP	=	1.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.63E+09	ug/l
Henry's Law Constant	H	=	1.10E-03	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.79E+06	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	1.10E-03	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.50E+00	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.90E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.79E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.83E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	5.97E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	2.95E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.95E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.54E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.62E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.62E-02 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.54E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: MTBE

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	3.29E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.38E+09	ug/l
Henry's Law Constant	H	=	2.40E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.31E+07	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.40E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.00E+00	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.87E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.31E+07 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.63E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	9.81E+02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.84E+00 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.84E+00 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.53E-01 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	7.58E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.58E-01 mg/kg-day
Reference dose	RfD	=	2.30E+00 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.53E-01 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Naphthalene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	1.00E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.54E+06 ug/l
Henry's Law Constant	H	=	2.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	5.08E+04 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.20E+03 cm ³ /gm
Soil/water distribution coef.	K _d	=	7.75E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.08E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	5.90E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.20E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	1.11E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	5.48E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 5.48E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.86E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	8.58E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.58E-04 mg/kg-day
Reference dose	RfD	=	2.60E-03 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.86E-04 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.20E+04 mg/mole
Vapor pressure	VP	=	3.74E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	4.22E+06 ug/l
Henry's Law Constant	H	=	2.70E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	1.14E+06 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	9.04E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.14E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.77E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	3.67E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.81E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.81E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	9.45E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.84E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.84E-02 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.45E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichlorofluoromethane (Freon 11)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.40E+05	mg/mole
Vapor pressure	VP	=	1.05E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	6.63E+05	ug/l
Henry's Law Constant	H	=	4.00E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	2.65E+06	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.00E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.60E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.03E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.65E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.77E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.54E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Version: November 1999

Risk Calculations

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.22E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.22E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.20E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.20E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Xylenes

Variable Descriptions Units

CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	1.05E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.10E+07	ug/l
Henry's Law Constant	H	=	3.00E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	3.30E+06	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	3.00E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00	gm/cc
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Water-filled porosity	θ _w	=	2.58E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.29E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=		mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.30E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01	dimensionless
Air-filled porosity	θ _a	=	1.92E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.43E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01	m
Calculated Flux	F_x	=	8.55E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.22E-01 mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m ³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.22E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.20E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.61E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.61E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.20E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,2-Dichloroethane (EDC)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	1.14E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.74E+04 ug/l
Henry's Law Constant	H	=	4.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.50E+03 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.45E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.50E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	2.04E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	5.54E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	2.73E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.73E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.43E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.28E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.28E-05 mg/kg-day
Reference dose	RfD	=	2.70E-02 mg/kg-day
Hazard Index	HI	=	1.59E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.43E-05 mg/kg-day
Slope factor (potency)	SF	=	7.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Dichlorodifluoromethane

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.20E+05 mg/mole
Vapor pressure	VP	=	5.77E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	2.00E+05 ug/l
Henry's Law Constant	H	=	4.10E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	8.20E+05 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.10E+00 dimensionless
Bulk density (dry)	P _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	3.74E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.20E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.63E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	2.43E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.20E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.20E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	6.26E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.88E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-02 mg/kg-day
Reference dose	RfD	=	5.70E-02 mg/kg-day
Hazard Index	HI	=	3.29E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.26E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Carbon tetrachloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.50E+05 mg/mole
Vapor pressure	VP	=	1.51E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	7.47E+02 ug/l
Henry's Law Constant	H	=	1.20E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	8.96E+02 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.20E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.47E+00 gm/cc
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Water-filled porosity	θ _w	=	2.58E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	6.45E-02 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.50E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	9.68E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.96E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.51E-01 dimensionless
Air-filled porosity	θ _a	=	1.92E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.59E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	1.98E+01 m
Calculated Flux	F_x	=	2.59E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.28E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.28E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	6.67E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.00E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.00E-05 mg/kg-day
Reference dose	RfD	=	6.86E-04 mg/kg-day
Hazard Index	HI	=	2.92E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.67E-06 mg/kg-day
Slope factor (potency)	SF	=	1.50E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f_{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
I-34-20	1/22/2001	20	Silt	1.51	24.1	0.45	0.10	0.36	500	0.05
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-004 (I-34-20)	1/29/2001	20	Silt	1.54	17.5	0.42	0.15	0.27	330	0.03
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.02
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA290176-012 (D-29-20)	1/29/2001	20	Silt	1.55	17.0	0.41	0.15	0.26	430	0.04
EIA290176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.06
EIA290176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
EIA290176-021 (I-25-20)	1/29/2001	20	Silt	1.37	20.2	0.48	0.20	0.28	410	0.04
EIA290176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.05
Average				1.47						
Notes:										
The air-filled porosity values were calculated from gravimetric data, not volumetric data.										
* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000										

0.45 0.19 0.26 645 0.06

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.	More prevalent and higher concentration volatile organic chemicals (VOCs)	MW (mg/mole)	H' (dimension-less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water) ¹	CSF (inh) (mg/kg-day) ⁻¹	Chronic RfD (inh) (mg/kg-day)
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	20	b	9.4E+01	a
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	25	b	2.7E+02	a
75-09-2	Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	25	b	1.0E+01	a
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	25	b	1.4E+02	a
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	25	b	6.5E+01	a
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	20	b	3.6E+01	a
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	30	b	3.8E+01	a
76-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E-01	25	b	1.9E+01	a
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	25	b	5.3E+01	a
79-00-5	1,1,2 - TCA	1.3E+05	a	3.7E-02	a	7.8E-02	31E-02	b	7.5E+01	a
71-43-2	Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	1.2E-01	b	6.2E+01	a
67-66-3	Chloroform	1.2E+05	a	1.9E-01	a	1.0E-01	25	b	5.3E+01	a
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	1.3E-01	b	2.0E+02	a
78-93-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	1.2E-01	b	4.5E+00	a
1634-04-4	MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	3.3E-01	b	6.0E+00	a
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	1.0E-04	b	1.2E+03	a
108-88-3	Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	3.7E-02	b	1.4E+02	a
75-69-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	a	8.7E-02	1.0E+00	b	1.6E+02	a
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	1.1E-02	b	2.0E+02	a
107-06-2	1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	25	b	3.8E+01	a
75-71-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	a	8.0E-02	5.8E+00	b	5.8E+02	a
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	1.5E-01	b	7.9E+02	a

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
- b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
- c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsds.ormi.gov/cgi-bin/tox/Tcx_Select?select=csf
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/rab2588/riskassess.htm>
- Toxicity Value reference priority:
1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/rab2588/riskassess.htm>
 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.